Material Handling and Safety in Paper Industry

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In any paper plant the type of material handling systems can be grouped in the following categories;

BELT CONVEYORS: For handling lime, Grit and stone, Bagasse pith, Coal/Leco, Bleached pulp/unbleached pulp, Depithed Bagasse, Hard wood chips and knots.

BUCKET ELEVATORS: For handling Burnt lime.

SCREW CONVEYORS: For handling Raw Bagasse, Depithed Bagasse, Bleached/unbleached pulp, Hard wood knots, Chip Bin levelling.

CHAIN CONVEYORS: For handling Wood and Reed logs.

STACKERS/RECLAIMERS: For handling coal, Wood chips.

The safety of the equipments is generally covered by the following description.

(A) CONVEYORS

1. Pull Chord Switches :

A chord running full length of conveyor which can be used by operational person to stop the conveyor in any emergency like, Belt tearing or excessive spillage of material or jamming of considerable number of rollers etc.

2. Zero Speed Switches :

Mounted near the snub pulley it senses the speed of the conveyor and trips the conveyor in case of speed being reduced than the designed speed due to some reasons like overloading, jamming of rollers, Belt snapping or Belt slippage. This signal is in turn transferred to stop all the motors and drive system.

3. Beltsway Switches :

Some times due to offcentre loading of material the belt has tendency to sway on the idlers which could result in excessive spillage of material or in extreme case moving of belt out of the idlers. This switch operates in such circumstances and trips all the drive units.

4. Hooters :

It is essentially a prewarning alarm which operates when the conveyor is switched 'ON' from the control room and allows sufficient time for people or workmen in the vicinity of conveyor to acquire safe position. Workmen walking on the belt or near the motor or near the gear box or near the highspeed coupling are hereby given an indication of starting of the conveyor system.

5. Guards :

Wiremesh guards are provided for all the rotating parts of the conveyor system so as to avoid hazards due to touching of any moving equipment rotating at high speed.

6. Hold backs for Gear Boxes :

For all the inclined conveyors the belt has a tendency to go in the reverse direction of operation when stopped due to the heavy material lying on it. Such a possibility is avoided by providing a holdback device which does not allow the gear box to rotate in the reverse direction and consequently the conveyor.

7. Dust Collection:

Suitable dust collection systems are provided as means of environmental pollution control to prevent the nuisance of material while discharging.

8. Brakes :

All the inclined conveyors are provided with

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failsafe type brakes for stopping and holding from accelerating due to the momentum of the material. They are called failsafe brakes as electric power is required to dislodge the brakes. This means the brake will automatically operate if there is any electrical failure of any kind.

B. STACKERS & RECLAIMERS

Stackers and Reclaimers are robust equipments and the manufacturers have done everything to make the operation of the equipment as safe as possible. Nevertheless. there is always room for human error that might cause severe damage to the stacker and reclaimer and human life. So it is highly imperative that such an equipment is operated by trained personnel only and unauthorised persons should not be allowed in the vicinity of the machines.

1. Prewarning Unit :

Before starting the machine either from local control or remote control, signals are given through siren or hooter for workmen to move away from the stockpile of machine. A time lag of 30 or 40 seconds is given in between and the operator has to press the start switch again so as to start operating. If operator does not press the start push button the machine again trips. This prevents the machine to be in 'Ready' state always before being operated.

2. Initial zone protection :

Stacker and Reclaimer are interrelated machines in the sense that they work very near to each other from one stockpile to another. For maximum material stacking, one cannot allow huge free space for reclaimer to operate as it would reduce the stockpile length.

The following example would highlight the possibility of the two machines colliding with each other.

Presume that, one stockpile has been completed by the stacker and the stacker has started creating a fresh stockpile nearby. The reclaimer which is positioned in between the two piles has to first start eating up the created pile to a certain distance. If this is not achieved there is always a chance of stacker boom colliding with the reclaimer harrow. For avoiding any such occurance, Anti collision switches are provided on both the machines that is stacker and reclaimer, which trips all the equipments and safeguards the machines.

3. Lubrication Monitoring :

For smooth and efficient running of the stacker and reclaimer, it is highly essential that proper lubrication is ensured. Lubrication cycle is entirely monitored by means of a special device called lubrication module. There are two lubrication lines connected from lubrication pump to a piston cylinder system. When the pump operates, one of the lines get energised and pushes the piston into opposite side resulting in lubrication of the machine by a fixed quantity of grease. When the piston reaches the other end, a switch known as alternating switch operates and the other lubrication line gets energised and piston moves in the opposite direction and this cycle repeats itself. If there occurs any leakage in any of the lines, the piston would not move to the other end as there will be no pressure. A supervisory time for alternating switch is allowed which trips the machine if alternating switch does not operate in that time span. This ensures adequate and timely lubrication of the machines.

4. Brakes :

Stacker and reclaimer are equipped with failsafe thrustor brakes ie., power is required to de-energise the brakes. It is highly essential to assure that there is no oil or contaminants on brake liners or brake drum.

5. Overload relays for drives :

All the drives are protected by overload relays.

6. Working range limit switch :

These switches are provided so as to define the working range of Stacker.

7. Travel end limit switches :

At the end of travel span, on both the sides, travel end limit switches are provided to stop the machine. These are used or required only when the working range limit switch fails to operate.

8. End stoppers :

They are provided at the end of the track, and

buffers are provided on the machine so as to have the last emergency stop by collision of buffers with the end stoppers. Such situation possibly could never occur.

9. Tilt Switches :

The height of material fall from the boom conveyor of stacker is to be kept to minimum so as to avoid nuisance of material and breaking of the crushed materials into fines, or rolling down big lumps over the pile. A tilt switch is mounted on the discharge chute of boom conveyor which senses the height of stockpile and boom luffing is controlled accordingly.

10. Material level controller :

M L C's are provided on the boom conveyor discharge chute and tripper of stacker to sense the presence of material. These sensors stop the stacking conveyor and Boom conveyor when there is no material. The unwanted movement of stacker will effect the blending efficiency of the preblending system.

The boom luffing highest and lowest positions are defined by a switch on boom which has striker on the stacker body. Similarly the slewing is monitored on positive and negative sides and the slewing angle can be monitored.

11. Cable reeling drum :

The cable reeling drum is provided with uudertension and overtension switches, so as to safeguard the cable and the machine. These switches trip the machine.

12. Rail Anchor :

Whenever the machine is stopped, rail anchors are used to anchor the machine in a fixed location.

13 Emergency stop facility :

The machine can be stopped from strategic points like staircases, drive station, floors through emergency push buttons.

14. Safety interlocks :

- Main incoming supply has a padlocking facility to prevent unauthorised energization of machine.
- The machine can start only when rail clamps are released.
- In reclaimer Auto mode travel is possible only in slow speed.
- When approaching a fresh stockpile in transportation speed, the machine automatically stops just before the stockpile to prevent the clashing of the machine on stockpile.
- Fast and slow travels cannot be operated simultaneously.
- The drives can be individually operated only in repair mode. Any operation is possible only after prewarning signal.

15. Wind speed :

If wind speed exceeds 75 KMPH the stacker/reclaimer are put out of operation. The rail anchors are applied. An anemometer is provided on the machine to sense the wind speed from time to time. The stacker boom must be kept in its lowest position and reclaimer harrow in its highest position.

16. The machine is equipped with flash lamps, tail lamps and lightening at suitable positions.

17. Material to be handled should be free from any foreign bodies like concrete blocks, wooden pieces etc. This can result in severe damage to the components of the machine.,

18. The travel tracks should be kept free from any obstruction which can cause derailment of the machine.

C. BUCKET ELEVATORS

- Arresting gear in the form of backstopping roller clutch or a ratchet and pawl mechanism, prevents the reversal of the carrying run in case of a motor stoppage.
- Chain bucket elevator are equipped with chain holdbacks. The bucket of belt elevators are interconnected by untensioned steel wire ropes running alongside the belt to keep the bucket in place should the belt break.
- Head sprocket wheels are provided with speed sensing switches, cutting out the drive motor in the event of belt or chain breakage.